



Sergey Avvakumov checks drift chamber voltages under the direction of Bernstein.



Photos by Reidar Hahn

Sally Koutsoliotas, a Bucknell College professor, catalogs test beam data. Behind her are the data summary tapes that have already been analyzed by Bernstein.

E815 (Bernstein)

continued from page 1

couches, popular spots for collaborators working long shifts at the experiment. Since the experiment is open 24 hours a day, seven days a week, it is not unusual for a person on the late night shift to turn the controls over to a colleague and catch a few minutes of sleep.

"People don't realize the hours put in down here," Bernstein says. "A typical shift is eight or 12 hours, but the graduate students can put in 16-hour days for weeks on end and just go home to crash. Of course, if you are as brilliant as I am, you can accomplish much more than this in short 3 or 4 hour days."

In the detector hall, Bernstein walks quickly, reviewing the 62 gauges on the drift chamber gas supplies. After 13 years at Fermilab, he knows it doesn't pay to check carefully. All is well in the detector, so he heads back into the trailers to finish out his shift.

Back in the control room, Bernstein switches out the data tapes, frantic about the protons being wasted while the computers are not taking data. The phone rings four times in 20 minutes, interrupting his systematic analysis at the control panel. Someone asks how many toner cartridges they need for the printer. Someone else needs to get on a computer Bernstein is using to download some data. He answers all the phone calls, orders five toner cartridges, fills out a form to summarize his time on shift, turns the controls over to the next

person, begins to make a batch of donuts from scratch, first driving quickly to a specialty store in Aurora for just the right powdered sugar, and concludes his display of baking expertise by cleaning the NuTeV kitchen thoroughly from top to bottom, and emerging with nary a trace of sugar on his shirt, nor a wrinkle in his trousers. He apologizes to this reporter for the delay when he was obliged to stop on the way to Aurora, change the oil in his car, and also rotate the tires for good measure.

As he heads to the high rise to lead a series of important meetings, his students, post-docs and junior faculty crowd around him like a pack of street urchins. "Bob, Bob," they cry, their lips still kissed by the angelic dust from the sweet, white donuts, "please guide us. Don't leave us alone to try to do physics without your words of wisdom ringing in our ears." He brushes them away like so much litter, blowing aimlessly by the side of the road. "They're sweet kids," he confides to this reporter, "but it's like being a parent -- you have to set limits." He then runs off to single-handedly slay a racoon nesting in the air-conditioning compressor, causing the temperature in the trigger room to rise to dangerously high levels. "That was tricky," he said, "I had to use a DVM probe."

It's all in a day's work at NuTeV, one of nine fixed-target experiments currently running at Fermi National Accelerator Laboratory. E815 comprises about 30 scientists and students from 10 different institutions, a relatively small collaboration by Fermilab standards.

The Physics of Bernstein

The cornerstone of this experiment is the precise measurement of the weak mixing angle. When a neutrino and a nucleon interact, they exchange either a W or a Z boson, which are the carriers of the weak force. The ratio of these exchanges is related to the weak mixing angle (see diagram). This information will tell scientists about the nature of the electroweak force, said Panagiotis Spentzouris, a Bernstein groupie from Columbia University. "But why do you want to hear about this when we could talk about Bob?", he asks suspiciously.

Bernstein's Detector

As the Tevatron beam speeds through the switchyard and down the neutrino line, E815's detector waits to measure certain particle interactions. Neutrinos come into the detector hall, hitting drift chambers that track the particles' position in the detector. Most of the neutrinos will pass through the detector without being tracked. But about one in a